**KFreas@CH2M.com**

09/23/02 01:04 PM

To: &lt;ceq\_nepa@fs.fed.us&gt;, &lt;Rhey\_Solomon@ceq.eop.gov&gt;

CC:

Subject: Revised CH2M Hill response to CEQ NEPA Task Force 9 July Federal Register Notice

Dear Mr. Solomon

I would appreciate it if you would use the attached FINAL COMMENTS AND CASE STUDIES CH2MHILL CEQ NEPA 23 September 2002 file for posting on your web site rather than the one sent earlier, which was titled COMMENTS AND CASE STUDIES CH2MHILL CEQ NEPA 23 September. The cover letter remains unchanged. The original email was sent at 10:13 PDT/1:13EDT.

I appreciate your assistance.  
Thank you.

**Kathy Freas Ph. D.****CH2M Hill**

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Sacramento, CA 95833

office (916) 920 0212 x223

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cell (916) 801 6364 FINAL COMMENTS AND CASE STUDIES CH2M HILL CEQ NEPA 23 September 2002.doc



Cover Letter CH2M Hill Comments to CEQ NEPA Task Force 23 Sept2.doc

September 23, 2002

Rhey Solomon  
Council on Environmental Quality  
NEPA Task Force  
P.O. Box 221150  
Salt Lake City, UT 84122

Subject: CH2M Hill Comments to CEQ NEPA Task Force

Dear Mr. Solomon:

In response to the 9 July 2002 Federal Register Notice, CH2M Hill is pleased to provide comments to the NEPA Task Force regarding opportunities to improve and modernize NEPA analyses and documentation.

CH2M Hill has more than two decades of experience conducting NEPA analyses and has completed thousands of NEPA documents. To respond to your request for comments and case studies to assist with your review of NEPA analyses, we have distilled the experience of many seasoned environmental planners, scientists, economists, and engineers into topics and specific experience that speak most directly to the issues highlighted in the notice. The document, attached here, is organized in response to study areas identified in the *Federal Register* notice, as follows:

A. Technology, Information Management, and Information Security

- General Comments
- Case Study: Application of eComment™, A Proprietary Comment Management Software, to Imperial Irrigation District EIR/EIS Public Review Period

D. Adaptive Management/Monitoring and Evaluation Plans

- General Comments
- Case Study: Using Habitat Equivalency Analysis (HEA) to Support Decisions Involving Ecological Trade-offs in NEPA Documents.

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Rhey Solomon  
Page 2  
September 24, 2002

We look forward to the Task Force conclusions and emerging guidelines for implementing the Act. Please contact Kathy Freas, Ph. D. ([kfreas@ch2m.com](mailto:kfreas@ch2m.com), 916.920.0300) with questions regarding information included in our comments and Case Studies.

Sincerely,

CH2M HILL

Michael D. Kennedy, PE  
President, Regional Operations

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**Council on Environmental Quality NEPA Task Force:  
Comments and Case Studies**

**Prepared by:  
CH2M Hill**

**23 September, 2002**

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## Study Area A. Technology, Information Management, and Information Security: General Comments 00533

The following are general comments and suggestions that are directed at the increasing use of e-mail and electronic access to the NEPA process and NEPA documents.

### **Provide Ability to Submit Comments on a Draft NEPA Documents via E-mail**

Consistently providing the ability to submit comments on a draft NEPA document by e-mail would substantially improve the public's access to an agency's decision-making process and enable individuals to provide input to a draft NEPA document in a cost-effective and timely manner.

The CEQ is in a unique position to establish guidance for specifying how all agencies receive electronic comments on NEPA documents. Guidance could include (1) requiring lead agencies to establish an appropriate email address; (2) notifying the public of the address as part of a Notice of Intent to prepare a NEPA document, scoping reports, official advertisements, or other formal notification process; (3) ensuring that comments received by e-mail are recorded, filed, and considered in the preparation of the NEPA document; and (4) ensuring that comments received by e-mail are considered equal to other written or verbal comments that may be received during the public/agency review of a NEPA document.

The cost to provide access to the public for submittal of comments is expected to be minimal. With adequate planning, e-mail accounts can be modified for the creation of new, document-specific accounts that will enable the public to submit comments directly to agency staff. Such an account could be set up readily to distribute comments to multiple parties, offices, or other team members responsible for preparing the specific NEPA document.

### **Establish a Single Web-based NEPA Document Repository**

Establishing a single web-based NEPA document repository and making it available for public access on an internet web page would improve the public's accessibility to past and pending NEPA documents and improve agency staff efficiency in the preparation of new documents. A web-based NEPA document repository could be constructed to maintain all NEPA documents directly for review/download or to provide hyperlinks to other agency internet webpages where the documents could be reviewed/downloaded. In either case, the web-based repository would provide the public and agency personnel with a single means to gain access to completed and pending NEPA documents.

The CEQ is well suited to undertake this action. An initial effort has been successfully implemented by CEQ with the addition of the NEPANet website, <http://ceq.eh.doe.gov/nepa/nepanet.htm>, which provides hyperlinks to several agency NEPA document web pages. This set of hyperlinks, however, is (1) limited in scope, (2) not always updated when changed by the individual agency, and (3) does not contain all NEPA documents prepared by the respective agencies.

The U.S. Environmental Protection Agency (USEPA) could assume this responsibility as part of its responsibility to prepare weekly Notices of Availability (NOA) in the *Federal*

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*Register*. The USEPA could assume the responsibility of ensuring that digital NEPA documents are available and accessible to the public at the time the NOA is published. While USEPA lists those NEPA documents available for review at its existing internet web page ([www.epa.gov/compliance/nepa/current/index](http://www.epa.gov/compliance/nepa/current/index)) and provides references to the *Federal Register* for past NOAs for NEPA documents, the process to gain access to a specific NEPA documents is cumbersome and often results in a document being unavailable electronically.

A single web-based repository containing digital NEPA documents could be created with existing technology. This action alone could improve the accessibility of the public and agency staff to the documents and would contribute to enhanced information available for decision-making and NEPA document preparation.

### **Linking Supporting Information to Digital NEPA Documents**

NEPA documents often contain references to past studies and analyses, appendices containing technical analyses, and illustrative exhibits such as maps, figures, GIS information, and other graphic materials. As a result, NEPA documents often fail to provide readers with the ability to review cited materials to determine if conclusions and findings can be verified.

Digital NEPA documents provide an opportunity to link such cited references to the text of the document, enabling the reader to review the references, technical studies, and exhibits on which conclusions are based. This would be especially beneficial for NEPA documents that directly reference previously prepared documents that discuss a series of actions in a programmatic manner.

CEQ has an opportunity to provide guidance on the linking of reference materials to NEPA documents. This could enable the public and other agencies to obtain supporting information on which conclusions and decision-making are based.

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## Study Area A: Technology, Information Management, and Information Security

### CASE STUDY SUMMARY

#### CATEGORY

Technology, Information Management, and Information Security

#### PROJECT

Application of eComment™ software, a proprietary comment management software, to Imperial Irrigation District EIR/EIS Public Review Period

#### PRACTICE

Comment Management Software, which facilitates and streamlines the process of responding to comments through a NEPA-mandated or other public review process.

#### AGENCY

Imperial Irrigation District (IID)

#### INVOLVED PARTIES

##### AGENCY CONTACT

Bill Smart, (303) 771-0900, ext. 2551, bsmart@ch2m.com; Valerie Ross, (215) 563-4224, ext. 447, vross@ch2m.com for information on eComment™ software.

##### DATES

*Began:* April 2002      *Ended:* June 2002

#### SUMMARY

Historically, responding to comments and managing the comment review process has been a labor-intensive activity requiring extensive time and effort. The magnitude of the effort, often conducted in a short time period, may detract from a project proponent's ability to understand the large-scale concerns of the commentors, linkages among comments, and detailed comments. In response to these challenges, CH2M HILL developed a proprietary software package, eComment™, which manages the entire comment/response process.

This case study describes how eComment™ supported the preparation of the Imperial Irrigation District EIR/EIS for their proposed Water Conservation and Transfer Project. The entire comment/response document was prepared in a 2-month period with production of the final 1,500-page report being completely automated and occurring within a 24-hour period. The benefits of eComment™ included the following:

- Improved the quality of work and management of the product by providing project management tools that previously were unavailable.
- Dramatically reduced the reliance on labor intensive manual tasks and reduced the labor effort of individual tasks by up to 75 percent.

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- Saved time through features such as standard comment response forms, expedited assignment of duplicate responses to duplicate comments, and automated document reproduction.
- Provided flexibility to respond to changing project and schedule needs by allowing additions to and restructuring of the order of comments at any time prior to publishing the Final EIS.
- Improved the quality of public information by facilitating preparation of technically accurate and legally defensible documents, including an accurate administrative record.
- Increased understanding of public issues and concerns by providing comment evaluative tools.
- Produced hardcopy and web-based deliverables that were reviewed on a daily basis.

## CONTEXT/BACKGROUND

Subsequent to the publication of draft environmental impact statements (DEISs), the public review process can result in the generation of thousands of comment letters from public agencies, environmental and trade organizations, and individual members of the public. Many of these letters are submitted with numerous comments and detailed technical attachments. Individual responses to each comment submitted must be prepared and published in a Final EIS. In addition to publishing the responses, copies of each comment letter, showing how each comment was addressed, must be included in the Final EIS.

Historically, the effort to organize and complete the "response to comments" has been a labor-intensive effort characterized by copying and organizing all the comment letters received, reading each one, and marking each letter individually to identify the numerous comments. Preparation of responses to comments requires extensive time and effort that largely is administrative. The magnitude of the effort, often conducted in a short time period, detracts from a project proponent's ability to understand the large-scale concerns of the commentors, as well as the detailed comments.

Use of simple databases and spreadsheets does not allow analysis of the comments or last minute structural changes based on receipt of late comments. It also does not provide key project management tools to allow the project team to track and expedite the response process. Use of off-the-shelf databases or spreadsheets also does not allow evaluation of links among comments and responses or testing of alternate response scenarios associated with complex major EISs.

In response to this need, CH2M HILL developed eComment™ software, a proprietary tool that supports the following functions:

- Allows individual letters received in response to an EIS to be efficiently tracked
- Allows for the creation of large, complex documents or smaller, less complex documents
- Captures all important and relevant components of the letter
- Assigns a categorical identifier to each comment

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- Allows multiple authors in multiple locations to respond to comments
- Establishes a process to ensure comments are adequately reviewed
- Allows for rapid sorting and categorization of comments and responses
- Allows for rapid production of comments and responses in standardized format
- Provides project management tools to maintain control over thousands of individual comments
- Allows web-based delivery

## PROJECT DESCRIPTION

The IID Water Conservation and Transfer Project is designed to reduce California's reliance on Colorado River water in a manner consistent with the Law of the River. IID is a customer-owned utility that provides irrigation water and electric power to the lower southeastern part of California's desert. The project, which has been in the planning stages for almost a decade, involves the proposed conservation of up to 300,000 acre-feet per year of Colorado River water currently used by IID and the subsequent transfer of all or part of the conserved water to other water agencies. The proposed project has been highly controversial because of the socioeconomic issues associated with removing agricultural fields from production and the environmental impacts associated with the proposed water diversion.

A joint Draft Environmental Impact Report/Environmental Impact Statement (EIR/EIS) was completed to assess potential effects of the IID Water Conservation and Transfer Project and the associated Draft Habitat Conservation Plan.

eComment™ software, which had been developed previously by CH2M HILL, was selected as a tool for Public Review Process because of the project's controversial nature, the expected magnitude of comments, the compressed schedule for completion of the final environmental documentation, and the desire of project proponents to perform ongoing reviews of comments and responses during preparation. Approximately 225 letters and 1,450 comments on the EIS/EIR were received.

## VALUE AS A PRACTICE

### *Result*

eComment™ software supported the preparation of the Final EIR/EIS and comment/response document in a 2-month period. The actual production of the final 1,500-page report was completely automated and occurred within a 24-hour period. Because of the ease of producing camera-ready documents, comments and completed responses were printed daily to allow ongoing review. Time savings of each stage of the comment/response process are estimated as:

- Comment Delineation and Responder Assignment: up to 75 percent time savings
- Tracking Responses: 50 percent to 75 percent time savings
- Preparing Responses: Unchanged with eComment™ software

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- Assigning Duplicate Responses to Duplicate Comments: 50 percent to 75 percent time savings
- Report Preparation: 50 percent to 75 percent time savings.

eComment™ software revolutionizes the comment response process in the following ways:

- **Improves the quality of the work and management of the product.** Historically, tracking progress in responding to comments has involved phone calls and emails to team members and tracking spreadsheets. Project managers who use eComment™ software can more easily monitor a project as it progresses, which allows them to continually improve the quality of the final product.
- **Saves time by dramatically reducing the reliance on labor intensive manual tasks.** Copying original letters, hand marking them to denote individual comments, multiple versions of wordprocessing, and hand pasting of comments and responses into a final camera-ready format all contributed to a focus on manual labor tasks. eComment™ software changes or eliminates many of these administrative activities.
- **Saves time by standardizing the comment response form for consistent use and application.** Creation of standardized approach with eComment™ software eliminates “reinventing the wheel” for each project application, and incorporates salient features that can be used for all project applications and for all EISs.
- **Provides flexibility to respond to changing project and schedule needs.** In the past, the labor-intensive process of organizing comments by responder (i.e., letters are categorized by agency, organization, and public) did not allow for consideration of last minute comment letters—or if late comments were considered, it resulted in labor-intensive reorganization of the comment letter and response package. eComment™ software allows additions to or restructuring the order of comments at any time prior to publishing the Final EIS, with minimal labor requirements to respond immediately to a client’s request.
- **Improves the quality of public information by facilitating preparation of technically accurate and legally defensible documents.** For federal and state projects (or for private sector projects requiring federal or state approvals), eComment™ software is effective at ensuring an accurate administrative record. In addition to reallocating project time and budget to focus on strategic development of responses, eComment™ software facilitates the preparation of the project’s Administrative Record. Regardless of the quality of the product, EISs frequently are subject to legal challenge by project opponents. eComment™ software eliminates the guesswork that often characterizes the preparation of the administrative record by maintaining a single repository for responses to comments. Without eComment™ software, extensive and labor-intensive activity is required to ensure that all comments and responses are available in a central location.
- **Increases understanding of public issues and concerns by providing comment evaluative tools.** With eComment™ software, comments and responses can be readily sorted and evaluated by categories, which allows for a better understanding of public concerns and more effective responses.

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### *Challenges Overcome*

Among the challenges that were overcome are the following:

- **Adapting to a new comment/review production process.** Despite the increased efficiency and effectiveness in preparing responses with eComment™ software, the process differs from that previously used. Reallocating time appropriately from old processes that were changed or eliminated to the new or changed production processes required some adjustments.
- **Need for greater variability in security features.** Enhanced security features were added, which provided different levels of software access for various roles.

### *Challenges Remaining*

Additional improvements are being implemented in response to specific client-identified needs. These may include features that allow the eComment™ software to be more user-friendly and adaptable to various work environments.

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## Study Area D. Adaptive Management/Monitoring and Evaluation Plans: General Comments

### Introduction

The National Environmental Policy Act (NEPA) intends to:

- Provide a thorough evaluation and disclosure of the environmental impacts (both beneficial and adverse) resulting from a proposed federal action
- Facilitate consideration of various alternatives to achieve the purpose of the proposed action
- Provide decision-makers with necessary and sufficient information to determine the future of an action or project and define the specific project components.

Through the evaluation and disclosure of environmental effects, NEPA encourages appropriate use and protection of the human environment. Adaptive management (AM) can play an important role in fulfilling this overarching goal of NEPA.

AM is most effectively applied to projects involving resource management issues, where considerable uncertainty surrounds the response of resources to management actions. A number of agencies recognize it as a component of natural resource management plans and programs undertaken to improve environmental conditions and as a component of regulatory compliance programs. With its current application to various environmental permitting and planning processes, AM already is a component of implementing the recommendations and requirements of the NEPA process. Explicit, formal incorporation of AM into NEPA processes is a logical next step.

The AM process acknowledges that projects and management actions will proceed in spite of uncertain outcomes. Often we cannot predict accurately the potential responses of resources to a proposed action. AM expresses management actions and policies in the form of testable hypotheses that predict the array of responses of resources to various changes in the environment (proposed projects or management actions). These hypotheses are tested through rigorous, focused monitoring programs that collect only data that are necessary and sufficient to test the hypotheses. Results of this monitoring either reject or provide support for the hypotheses tested, thus enhancing predictive ability about the response of the resources to the action in question. This additional understanding allows the management regime or project implementation to be modified, if appropriate, to better achieve the desired outcome.

Scientific rigor in AM programs is key to the validity of the results. Hypotheses must be rigorously crafted to reflect potential responses of the resource being managed and monitoring programs must be tailored precisely to test hypotheses. Inadequate data collection (type, quality, or quantity) will invalidate conclusions and adversely affect subsequent decision-making.

AM has value beyond that for decision-makers on individual projects. The great benefit of a broad-scale AM program implemented systematically over multiple agencies is the accrual of

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a broad knowledge base that includes documented responses of resources to an array of management actions. This knowledge base thus improves predictive ability for all future related decision-making.

### **Federal Register Questions**

#### **1. What factors are considered when deciding to use an AM approach?**

The appropriate use of an AM program in a project and the likelihood of the success of the AM program depend on many factors, including the following:

- **Can the desired future condition be clearly defined?** AM is a process for implementing actions, monitoring the results, and adjusting management actions to achieve a desired outcome. The success of an AM program depends on a clear definition of the objectives of a management program and identification of ways to measure achievement of the objectives. Where multiple stakeholders are involved, agreement on the objectives and measurement of performance to meet objectives is an essential first step. Lacking concurrence on these issues can result in failure of the AM program.
- **Is there uncertainty or disagreement about the response of a resource to a management action?** Uncertainty associated with anticipated ecosystem response sometimes creates opposition to the use and management of natural resources. By providing empirically valid, cumulative predictive ability about the response, AM ultimately can be an effective means for resolving conflict regarding uncertainty and for facilitating project progress.
- **Can management actions be structured and applied experimentally?** This is critical to a valid AM program. As a science-based, hypothesis-driven process, AM demands that management actions be applied in a systematic manner consistent with hypothesis testing. Associated institutional structures must be sufficiently flexible to allow experimentation, and sufficiently strong that individuals cannot arbitrarily alter the design.
- **Will decision-makers and stakeholders commit to participating in a long-term program potentially spanning many years? Are they willing to make adjustments over time?** A fatal flaw of many AM programs is the lack of long-term commitment and follow-through. While stakeholders and decision-makers commonly are engaged during the project development stage, they often disperse following final project approval as other projects demand their attention. Successful implementation of an AM program depends on their long-term involvement, thus incentives to continue in the program are critical to success.
- **Is there sufficient funding and institutional structure and consistency to support the process (stakeholder activities, data collection and analysis, etc.) for a protracted period?** In addition to having the commitment of stakeholders, AM can be successful only if there is long-term support to implement the program. AM represents a change in the way we currently view management and monitoring, thus existing annual appropriations that are subject to political expediency could easily undermine the value of AM programs. A change in the process for funding monitoring programs that are AM based is necessary.

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**2. How can environmental impact analyses be structured to consider AM? and  
3. What aspects of AM may, or may not, require subsequent NEPA analyses?**

An impact analysis under NEPA that includes AM must consider the effects of the AM program on both target and nontarget resources that may be affected by the project or management actions. To evaluate the effect of the AM program on the target resource, the desired future conditions should be defined as quantitatively as possible. An impact/benefit evaluation can assess the effect of moving toward this desired future condition. The environmental document, thus, would be able to identify and disclose the direction and greatest magnitude of change potentially resulting under the AM program for the target resource.

To assess the effects on nontarget resources, potential actions could be evaluated on the basis of how well they are defined. Well-defined actions could be evaluated at a project level in the NEPA document and would not require subsequent review under NEPA. Less well-defined actions could be evaluated programmatically in the NEPA document. While subsequent environmental review to evaluate the impact of less well-defined actions would be necessary to implement them, the subsequent NEPA review process would be streamlined due to the ability to tier from the programmatic evaluation. This approach would allow coverage of a wide range of possible actions.

Over the course of the AM program, new management techniques or approaches might become available. Implementation of management actions not identified and evaluated in the original NEPA review, either at the project level or programmatically, could require subsequent environmental review.

AM could reveal a need for subsequent NEPA analyses if the increased understanding of the system gained through AM indicates a substantially greater magnitude of impact than originally predicted.

**4. What factors should be considered (e.g., cost, timing, staffing needs, environmental risks) when determining what monitoring techniques and levels of monitoring intensity are appropriate during the implementation of an AM regime? How does this differ from current monitoring activities?**

A remaining challenge to integrate AM into NEPA processes is managing the required monitoring and data analysis. Monitoring associated with NEPA processes typically is focused on compliance and addresses whether actions are implemented correctly and specific values or standards are achieved. Occasionally, data to evaluate the effectiveness of an action in producing a desired effect are collected. These types of monitoring programs typically lack the larger conceptual framework within which to interpret monitoring data for management purposes and have limited value for making management decisions.

Monitoring for AM programs has two primary purposes:

- Track progress toward the desired condition
- Improve understanding of the system to serve as a foundation for management adjustments

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Monitoring for an AM program, thus, goes beyond compliance and effectiveness monitoring and seeks to determine not only if an action was effective, but to understand why an action was or was not effective.

A successful AM monitoring program clearly defines the goals and objectives, identifies the response variables to be measured, and establishes success criteria. An AM monitoring program should focus on monitoring key relationships that have a large bearing on deciding the appropriate management action and collecting data necessary and sufficient to answer the specific questions relevant to making sound management decisions.

Essential elements of developing and implementing a monitoring program include:

- Identifying key risks (resource responses that can be quantified) and uncertainties (resources responses that cannot be quantified)
- Identifying the data set necessary and sufficient to guide decision-making with a reasonable expectation that the resource will move toward the desired condition
- Identifying and defining the most cost-effective monitoring program to provide the information necessary to evaluate performance of the management action compared to expectations, within stated policy goals and objectives
- Availability of long-term funding
- Availability of sufficient staff with appropriate technical skills to design a scientifically valid AM program and conduct monitoring
- Commitment of decision-makers and stakeholders to reviewing and understanding monitoring results and making adjustments if and when necessary
- Long-term maintenance of stakeholder involvement and information dissemination and education processes

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## Study Area D. Adaptive Management/Monitoring and Evaluation Plans

# CASE STUDY SUMMARY

### CATEGORY

Adaptive Management/Monitoring and Evaluation Plans

### PROJECT

Using Habitat Equivalency Analysis (HEA) to Support Decisions Involving Ecological Tradeoffs

### PRACTICE

The habitat equivalency analysis (HEA) method is used to perform a range of functions related to decisions involving ecological tradeoffs. These types of decisions are integral to implementation of the National Environmental Policy Act (NEPA) and to alternatives analyses, impact assessments, and mitigation decisions. Specifically HEA provides a mechanism to:

- Determine sufficient mitigation offsets for an environmental impact
- Identify/prescreen project alternatives
- Evaluate project alternatives
- Rank project alternatives
- Select cost-effective project alternatives
- Document and defend alternative selection process
- Provide performance-based measures for conducting monitoring and adaptive management activities

### AGENCY

The HEA method applies to actions involving ecological tradeoffs undertaken by all federal agencies. This approach, known as the *service-to-service approach*, is supported by many federal agencies (e.g., Department of Interior [DOI] 1997; National Oceanic and Atmospheric Administration [NOAA] 1997; U.S. Environmental Protection Agency [USEPA] 1999) and in federal court rulings (USA vs. M. Fisher et al. 1997) as a valid approach for determining compensation for habitat impacts and for measuring environmental improvement. The approach also has been used in multiple states across the United States (California, Texas, New Jersey, South Carolina, Virginia, Indiana, Louisiana, Florida, Oregon, Idaho, Alabama) and is consistent with recent thinking by the U.S. Army Corps of Engineers (USACOE) (King et al. 2000; USACOE 2001).

### INVOLVED PARTIES

In general, HEA has applications to projects involving private industry, local communities, environmental groups and other non-governmental organizations. In this case study, the involved parties were the USACOE and a Pipeline Company.

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## AGENCY CONTACT

For more information on Habitat Equivalency Analysis, contact Brian Julius (301) 713-3038 ext. 199; [David.Chapman@Noaa.gov](mailto:David.Chapman@Noaa.gov). For more information on the specific case study, contact Joe Nicolette, (770) 517-9154; [Jnicolette@CH2M.com](mailto:Jnicolette@CH2M.com) or Mary Jo Kealy, (302) 478-1521; [Mkealy@ch2m.com](mailto:Mkealy@ch2m.com).

**DATES**      *Began: 1990    Ended: ongoing*

## SUMMARY

This Habitat Equivalency Analysis (HEA) case study illustrates a practice related to supporting decisions involving ecological trade-offs. Example functions include:

1. Determining sufficient mitigation offsets for an environmental impact;
2. Identifying /pre-screening project alternatives;
3. Evaluating project alternatives;
4. Ranking project alternatives;
5. Selecting cost-effective project alternatives;
6. Documenting and defending alternative selection process; and,
7. Providing performance-based measures for conducting monitoring and adaptive management activities.

This case study briefly describes the history of the HEA tool, including a general discussion of how it has been applied in other contexts and by whom. It includes a specific example with direct applicability to mitigating for environmental impacts in the NEPA context.

## CONTEXT/BACKGROUND

### *What Are Natural Resource Services?*

From the Oil Pollution Act (1996) regulations, "Services (or natural resource services) means the functions performed by a natural resource for the benefit of another natural resource and/or the public." NOAA guidance further classifies natural resource services as either (1) *ecological services*: the physical, chemical, or biological functions that one natural resource provides for another natural resource and indirectly provides value to the public (e.g., the provision of food for wildlife, protection from predation, and nesting habitat, among others), or (2) *human use services*: the human uses of natural resources or functions of natural resources that provide direct value to the public (e.g., fishing, hunting, birdwatching, boating, nature photography, and education).

### *The Service-to-Service Approach*

The increased focus on natural resource values is exemplified in natural resource damage assessment (NRDA) cases, wherein the natural resource trustee agencies seek appropriate compensation for habitat injury by developing a compensatory resource-based restoration program. In this process, natural resource services (ecological and human use) injured as a result of the regulated action and the natural resource services gained by various restoration

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projects are quantified so that the compensatory restoration program can be scaled to the level of injury.

In the service-to-service approach, natural resource service gains and losses are not quantified in terms of dollars but by habitat service metrics. For example, ecological service gains and losses typically are quantified in a metric known as a service-acre-year (i.e., ecological services provided per acre per year). Human use services (e.g., recreation) can be quantified in user days, which ultimately can be translated into dollars. The intent of the service-to-service approach is to provide the public with ecological services equivalent to those injured or lost as a result of a management action, contaminant release, etc.

In addition to quantifying habitat losses, the resulting changes in natural resource values (e.g., gain in services) associated with various mitigation actions (e.g., habitat conservation, preservation, acquisition, enhancement, or creation) can be quantified. By quantifying service losses and service gains, the level of mitigation can be scaled to the level of injury or loss.

Various economic models are used to quantify the dollar value of losses and gains in ecological and human use natural resource services (USEPA 2000). The following discussion focuses on ecological tradeoffs (i.e., scaling ecological mitigation, restoration, and compensation to offset impacts and to identify, evaluate, and rank alternatives on the basis of ecological value and cost). For the technical details on the HEA approach and additional case studies, see King and Adler 1991; NOAA 1992; Massotta et al. 1993; Unsworth and Bishop 1994; NOAA 1995; NOAA 1998; Fonseca et al. 2000; Nicolette, Rockel, and Kealy 2001.

## PROJECT DESCRIPTION

### *Purpose*

In 1999, a petroleum products pipeline company sought to expand a portion of their pipeline system. The primary impact would be to a forested wetland area with 1-to 5-year-old growth). The expansion required that they receive a Nationwide Permit #12 from the USACOE since the expansion would cross wetland habitat. The USACOE requested that the pipeline company mitigate for permanent (6.1 acres) and temporary (15.5 acres) wetland impacts by purchasing 26.5 acres of forested wetland from a local mitigation bank with 50-year-old trees and old growth wetland area.

### *Challenge*

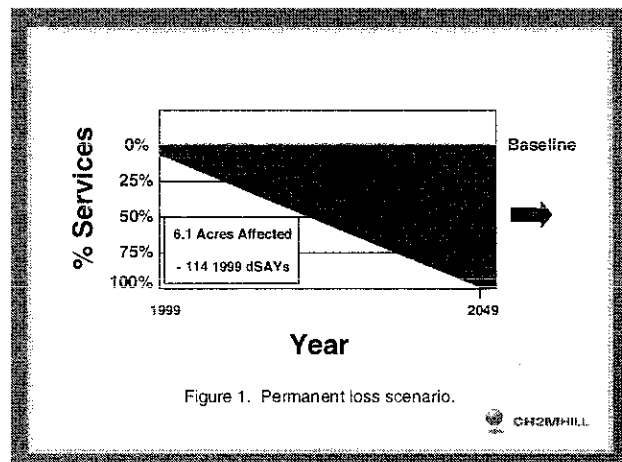
The USACOE requested a mitigation ratio of 1:1 for temporary impacts and a mitigation ratio of 1:1.8 for permanent impacts. The necessary mitigation for 15.5 acres of temporary impacts was 15.5 acres ( $15.5 \times 1.0$ ) and the necessary mitigation for the permanent impacts was 11 acres ( $6.1 \times 1.8$ ), totaling 26.5 acres of requested mitigation. The pipeline company felt that this required acreage was high given the limited impacts thought to be associated with construction and siting of the pipeline system. Accordingly, they evaluated the impacts and necessary mitigation based upon the habitat equivalency analysis framework. The evaluation framework, endorsed by NOAA, DOI, NPS, EPA, and USFWS, was used to provide a scientific, defensible basis for determining the necessary mitigation.

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### Permanent Loss Calculation

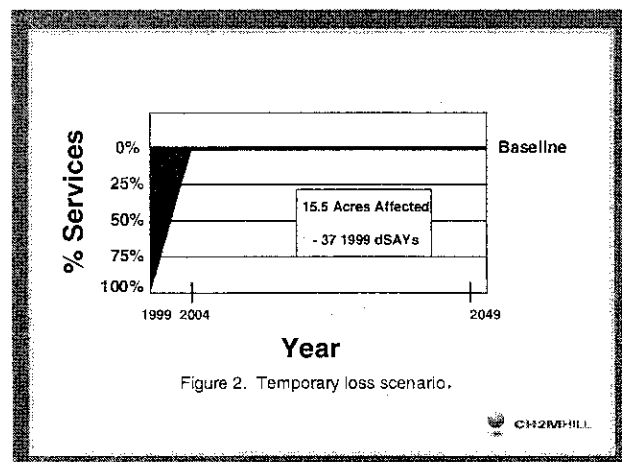
The USACOE assumed that permanent impacts would result along the pipeline corridor and that the right-of-way would be maintained to prevent old growth from occurring along the pipeline right-of-way. For the injury or service loss analysis of permanent impacts to the 6.1-acre corridor of forested wetlands with 1-to-5-year-old growth, we assumed a worst-case scenario. It was assumed that on the 6.1 acres, there would be a loss of 5 percent of services initially reflecting the existing age (1 to 5 years) of the stand of trees on the site and linearly declining for 50 years, reaching a 100 percent of lost services forever. This scenario equates the growth and the age of trees to services losses over time. If the stand of trees is 1 to 5 years old, then not having those trees forever represents a loss in services of those trees as they reach maturity (assumed to be 50 years) and from then on into perpetuity. This scenario (Figure 1) assumes a worst case where all services are lost in the 6.1 acres (even though wetland services would still be provided by the 6.1 acres of maintained right-of-way).

Based upon the assumptions listed, the projected loss of ecological services on this 6.1 acres from 1999 into perpetuity is 114 discounted service-acre-years (dSAyS). As discussed with the HEA framework, ecological service flows can be expressed in service-acre-years. One acre of habitat producing ecological services over 1 year will have produced 1 service-acre-year of services. If that acre of habitat exists for 2 years, it will produce 2 service-acre-years over time. The service-acre-year metric is a convenient way to express the amount of services provided by a habitat over time. By discounting service-acre-years, we can be assured that the amount of ecological service diminished and interrupted by the project from the present and into the future (the loss of ecological services that the public will forego) is mitigated by providing an equivalent or larger quantity of ecological service flows sometime in the future.



### Temporary Loss Calculation

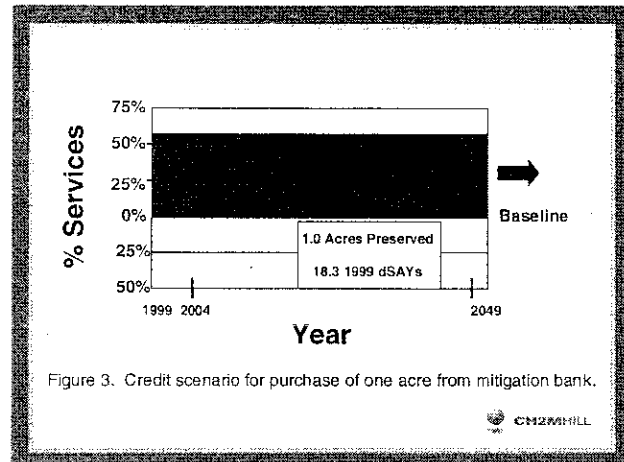
The USACOE contended that 15.5 acres of habitat would be affected temporarily by the project. This would result from staging areas along the expansion route where pipe and associated construction materials would be stored. Of the 15.5 acres temporarily affected, the ecological services would begin to return within about 1 month from project inception. For the temporary impact scenario, we assumed a 100-percent loss of wetland services immediately, with a linear increase of services back to the pre-impact baseline over a 5-year period (time to get back to the 5-year-old growth forested wetland stage: the pre-



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impact baseline). In this scenario, the calculated debit associated with temporary impacts to 15.5 acres was approximately -37 dSAys (Figure 2).

Therefore, the overall service loss (permanent and temporary impacts combined) associated with the pipeline expansion using the HEA methodology was estimated to be approximately -151 dSAys (-114 dSAys plus -37 dSAys). This approach provides a quantitative, cumulative assessment of temporary and permanent impacts.



### *Credit Calculation*

The credit calculation was based on the production of ecological service flows over time from the mitigation bank. We assumed that the ecological service flows provided by the bank are 100 percent of mature habitat services and will continue to be provided forever. The relative quality of service flows from the mitigation bank to that of the affected habitat, expressed in percentage terms is assumed conservatively to be 1:1 or 100 percent (e.g., the quality/value of habitat in the mitigation bank is the same as the quality/value of the injured habitat). This is a conservative estimate because we know that the habitat at the injured site (1-to 5-year-old growth forested wetland) is of lower quality/value when compared to the acreage at the mitigation bank (50-year-old growth forested wetland).

Discussions with the USACOE indicated that because of the imminent threat from development to the habitat in the mitigation bank, the USACOE was requesting a mitigation ratio of 1.8:1, if the credits were to be purchased from the bank. A mitigation ratio of a 1.8 bank purchase to 1 acre affected implies a relative productivity value of 55 percent ( $1.0 \div 1.8$ ); that is, the USACOE is giving credit for 55 percent of the services on each acre preserved. To understand this, consider that if the ratio was 1:1, each unit of habitat preserved would compensate for one habitat unit affected, thus giving credit for 100 percent of the ecological services in the unit preserved. Mitigating with a 2:1 ratio implies that each one unit of habitat preserved would compensate for half a unit, thus giving credit for only 50 percent of the ecological services preserved. In this case, given a mitigation ratio of 1.8:1, we assumed that the USACOE is giving credit for 55 percent of the services for each acre preserved out of the mitigation bank.

For our credit scenario, we assumed that the purchase of 1 acre from the mitigation bank would provide 55 percent of the services into perpetuity. Each acre purchased from the bank, therefore, would generate 18.3 dSAys (Figure 3).

### *Final Evaluation and Summary*

Given an overall loss of approximately -151 dSAys and the fact that the purchase of 1 acre of forested wetland from the mitigation bank would provide 18.3 dSAys of habitat services, the HEA analyses determined that the pipeline company should be required to purchase

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8.25 acres (151/18.3) from the mitigation bank, not 26.5 as originally required. This analysis was presented to the USACOE and enabled the pipeline company to negotiate a final resolution with the USACOE of a purchase of 10 acres from the mitigation bank. This analysis provided the pipeline project manager and the USACOE project manager a scientifically-based credible justification as to why the purchase of 10 acres from the mitigation bank was reasonable, resulting in a win-win situation for the parties involved.

## **INTERNET SITE**

Additional information on the Habitat Equivalency Analysis approach can be found at <https://www.response.restoration.noaa.gov>.

## **VALUE AS A PRACTICE**

### *Results*

Decisions involving mitigating environmental impacts and otherwise making ecological tradeoffs are becoming more difficult with increased growth and development and a shrinking resource base. The ecological consequences of new federal actions are becoming increasingly important to resource management agencies and other stakeholders who need and want to know how a decision will affect their environmental interests.

The purpose of the HEA approach is to contribute toward making better decisions involving ecological tradeoffs, where "better" is defined as systematic, consistent, defensible, and understandable to stakeholders. Decisions that have these traits tend to achieve environmental objectives at least cost and with utmost speed relative to arbitrary decisions or even informed qualitative decisions. In summary, this practice provides the following benefits:

- Systematic, consistent and defensible, decisions that are understandable to stakeholders
- Demonstrable win for the environment
- Demonstrable win for the bottom line (i.e., improves the efficiency in the allocation of resources and the savings can usually be documented)
- Expedited negotiations by making good use of the existing information

### *Challenges Overcome*

In this specific case study, the industry party and the consultant were familiar with the HEA approach. The approach was new to the USACOE, but ultimately, they were responsive to the concept of determining the type and amount of mitigation using a consistent and scientifically defensible method.

In a broader context, the HEA approach has been widely applied to scaling mitigation and resource-based compensation decisions in the context of Natural Resource Damage Assessments and site remediation. The use of this tool has evolved over time and has increased as state and federal agency personnel and other interested parties have become increasingly familiar with its advantages and disadvantages in terms of meeting the objectives of the Oil Pollution Act of (1990), the Comprehensive Environmental Response, Compensation and Liability Act of (1990), and the Resource Conservation and Recovery Act of 1976. By including this and other tools in the regulatory guidance documents, the

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agencies have contributed to overcoming challenges related to familiarity and agency acceptability that are typically associated with applying new technologies or transferring existing technologies to new applications.

### *Challenges Remaining*

- Agency acceptance of transferring the practice to NEPA applications on a broader scale
- NEPA guidance on the HEA tool and how it can be applied
- Practitioner experience with the tool

### *Source of Information/References*

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